Geometry

Some Geometry standards are intended to cover the entire course, and, as such, are listed in several places in the content outline.

Course Description

Geometry is the mathematical study of shapes, their properties, and their relationships. The course competencies are presented as a one-year traditional or one-semester block course that meets the state geometry standards. Emphasis is placed on student discovery and exploration and on formulating and defending conjectures. Geometry includes an in-depth study of reasoning, polygons, congruence, similarity, right triangles, circles, area, volume, and transformations. Students will use a variety of approaches, such as coordinate, transformational, and axiomatic systems. **Geometry I.B.2.** They will also develop an appreciation for the connections between geometry and other disciplines such as art and architecture.

Students are expected to use technology throughout the course, particularly interactive, dynamic software.   **Geometry: I.D.2.**

It is recommended that class size be no larger than twenty-five students because of the computer-based nature of the class.

Recommended Prerequisites

Students entering this course should have successfully completed Algebra 1 or its equivalent, having mastered the state-mandated Algebra 1 standards.

Course Outline

Students who complete the geometry course will know and understand the core materials in the outline below. Boldfaced items indicate additional material to be covered in geometry at the honors level. All topics should be taught in greater depth and difficulty at the honors level.

I. Exploration and overview of geometry.
    A. Develop an awareness of the structure of a mathematical system, connecting definitions and postulates. **Geometry: I.A.1.**
    B. Recognize that the study of geometry was developed for a variety of purposes and has historical significance. **Geometry: I.A.2.**
    C. Define basic geometric terms. **Geometry:** Part of **I.A.1.**
    D. Explore attributes of geometric figures using **Geometry: I.B.1.**
        1. Constructions with straightedge and compass.
        2. Paper folding.
        3. Dynamic, interactive geometry software.

E. Explore the basic transformations. **Geometry: III.B.1.,2.**
   1. Translation.
   2. Rotation.
   3. Reflection.
   4. Dilation.
II. Logical reasoning.
   A. Define and use conditional statements. **Geometry: part of I.A.1.**
   B. Determine the truth value of the converse of a conditional statement.
      Geometry: I.C.1
   C. Use logical reasoning to draw conclusions about geometric figures from given assumptions. **Geometry: I.C.2.**
   D. Construct and judge validity of a logical argument consisting of a set of premises and a conclusion. **Geometry: I.C.3.**
   E. Use inductive reasoning to formulate a conjecture. **Geometry: I.C.4.**
   F. Use deductive reasoning to prove a statement. **Geometry: I.C.5.**
   G. Find the contrapositive, converse, and inverse of a statement.
   H. Write and use counterexamples.
   I. Determine the truth of a conditional statement using a truth table.
   J. Determine the validity or invalidity of an argument using truth tables.
   K. Use truth tables to show that statements are tautologies, contradictions, or are logically equivalent.
III. Lines and triangles.
   A. Based on explorations and using concrete models and geometry software, formulate and test conjectures about properties of **Geometry: IV.B.1.a.**
      1. Parallel lines.
      2. Perpendicular lines.
      3. Two parallel lines cut by a transversal line.
   B. Use numeric and geometric patterns to make generalizations about **Geometry: II.A.1.**
      1. Angle relationships.
      2. Inequalities in triangles.
   C. Justify and apply triangle congruence relationships. **Geometry: V.B.2.**
   D. Use congruence transformations to make conjectures about and justify properties of triangles. **Geometry: V.B.1.**
   E. Identify, describe, and defend congruence between shapes. **Geometry: V.B.3.**
IV. Polygons and quadrilaterals.
   A. Use numeric and geometric patterns to make generalizations about properties of **Geometry: II.A.1.**
      1. Polygons.
      2. Angle relationships in polygons.
   B. Based on explorations and use of concrete models and geometry software, formulate and test conjectures about properties and attributes of polygons and their component parts. **Geometry: IV.B.1.b.**

C. Explore symmetry in regular polygons, and analyze the symmetry of objects using the language of transformations.   **Geometry: III.B.3.**

D. Use transformations and their compositions to make connections between mathematics and applications including tessellations or fractals, in particular with graphing calculators and geometry software.   **Geometry: III.B.4.**

E. Find optimal solutions to problems involving paths, networks, or relationships among a finite number of objects, using digraphs or vertex-edge graphs.   **Geometry: I.D.3.**

V. Coordinate geometry.

A. Given geometric figures, utilize a coordinate system to identify and justify conjectures.   **Geometry: III.A.1.**

B. Use slopes and equations of lines to investigate geometric relationships of   **Geometry: III.A.2.**
   1. Parallel lines.
   2. Perpendicular lines.
   3. Special segments of triangles.
   4. Special segments of other polygons.

C. Develop and use formulas including distance and midpoint.   **Geometry: III.A.3.**

D. Given two ordered pairs   **Geometry: III.A.4.**
   1. Find the distance between them.
   2. Locate the midpoint.
   3. Determine the slope of the line that contains them.

E. Plot coordinates for translations and describe the vertical and horizontal transformational vector(s).   **Geometry: III.B.1.**

VI. Area and perimeter.

A. Find areas of   **Geometry: IV.A.1.**
   1. Regular polygons.
   2. Composite figures.
   3. Circles.

B. Using graphing calculators, spreadsheets and dynamic, interactive geometry software, determine and describe the resulting change in the area and perimeter when one or more dimensions is changed, and apply this idea in solving problems.   **Geometry: I.D.1., IV.A.5., V.A.7.**

C. Develop and use Pick's theorem for finding the area of an irregular polygon.

VII. Three-dimensional figures.

A. Use numeric and geometric patterns to make generalizations about solid figures.   **Geometry: II.A.1.**

B. Draw, examine, and classify cross sections of three-dimensional objects.   **Geometry: II.A.3.**

C. Construct a three-dimensional object using a two-dimensional diagram such as a blueprint or pattern.   **Geometry: II.A.4.**

D. Use top, front, side, and corner views of three-dimensional objects to create accurate and complete representations and solve problems.   **Geometry: I.D.1., II.A.5.**

E. Represent a three-dimensional object in two dimensions using graph or dot paper. **Geometry: II.A.6.**
F. Use formulas for surface area and volume of three-dimensional objects to solve practical problems. **Geometry: I.D.1., IV.A.4.**
G. Using graphing calculators, spreadsheets, and dynamic, interactive geometry software, determine and describe the resulting change in volume when one or more dimensions is changed. **Geometry: IV.A.5.; V.A.7.**

VIII. Similarity.
A. Use numeric and geometric patterns to make generalizations about ratios in similar figures. **Geometry: II.A.1.**
B. Identify, describe, and defend similarity between shapes. **Geometry: V.A.1.**
C. Justify conjectures about geometric figures using similarity and transformations. **Geometry: V.A.2.**
D. Utilize ratios to solve problems involving similar figures in a variety of ways, including the use of dynamic, interactive geometry software. **Geometry: I.D.1., V.A.3.**
E. Solve applied problems using scale modeling. **Geometry: I.D.1., V.A.4.**
F. Solve problems using proportion involving similar figures. **Geometry: I.D.1., V.A.8.**
G. Develop, apply, and justify triangle similarity relationships. **Geometry: V.A.5.**

IX. Right triangles.
A. Develop, extend, use, and prove the Pythagorean Theorem. **Geometry: IV.A.3.**
B. Identify and use the right triangle theorems for
   1. 45°-45°-90° triangles.
   2. 30°-60°-90° triangles.
C. Identify and apply patterns from right triangles to solve problems. **Geometry: I.D.1., II.A.2.**
D. Explore concepts and applications of trigonometry by solving applied problems using right triangle trigonometry (sine, cosine, and tangent). **Geometry: I.D.1., V.A.6.**

X. Circles.
A. Use numeric and geometric patterns to make generalizations about circles. **Geometry: II.A.1.**
B. Find areas of sectors and arc lengths of circles using proportional reasoning. **Geometry: IV.A.2.**
C. Based on explorations and using concrete models and geometry software, formulate and test conjectures about properties and attributes of circles and the lines that intersect them. **Geometry: IV.B.1.c.**